WHAT IS CLAIMED IS:

1. A machine tool comprising:

a main shaft for installing a tool, an electric motor provided at the shaft head, for rotating said main shaft, an electric drive circuit (inverter) for driving said electric motor, a controller for controlling said inverter, and a tool data setting means for pre-setting the magnitude of the power output of said electric motor which is suitable for the working condition of each said tool used, the desired working being done to a work piece by moving relatively said tool and said work piece, wherein

said electric motor comprises:

a stator having a primary winding, and a rotor having a field magnet and a shaft, said field magnet comprising a first field magnet having different polarity magnetic poles sequentially arranged in a rotating direction and a second field magnet having different polarity magnetic poles sequentially arranged in a rotating direction, and

a mechanism for shifting one field magnet in axial and rotating directions with respect to the other field magnet,

whereby a composite magnetic field of said first and said second field magnets is changed.

2. A machine tool according to claim 1, wherein

said electric motor comprises:

a stator having a primary winding, and a rotor having a field magnet and a shaft, said field magnet comprising a first field magnet having different polarity magnetic poles sequentially arranged in a rotating direction and a second field magnet having different polarity magnetic poles sequentially arranged in a rotating direction, said first and said second field magnets being opposite to magnetic poles of said stator; and

a mechanism for changing a composite magnetic field of said first and said second field magnets with respect to the magnetic pole of said first field magnet depending on a direction of torque, said mechanism for changing depending on a direction of torque comprising a means of making magnetic pole centers of equal-polarity of said first and said second field magnets in phase by a direction of torque generated in said rotor and by balance of magnetic action forces between said first and said second field magnets; and a means of changing the composite magnetic field of said first and said second field magnets when the direction of torque generated in the rotor is reversed.

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3. An electric motor according to claim 1 or 2, wherein

said mechanism for shifting one field magnet with respect to the other field magnet is constructed so that one field magnet may be fixed to a shaft, and the other field magnet may be provided movably and freely with respect to said shaft, and said field magnets have screw functions to be connected to each other

by forming a bolt screw portion in said shaft and a nut portion inside said second field magnet, and

further comprising a stopper at a position apart from a side surface of the other field magnet.

4. An electric motor according to claim 3, wherein said stopper has a servomechanism capable of moving said stopper in parallel to said shaft according to a rotating speed of said motor as needed.

5. An electric motor according to claim 1 or claim 2, wherein a lead angle of current supply by a controller for controlling said controller is corrected according to a positional shift of a composite magnetic pole of said first field magnet and said second field magnet.

6. An electric motor according to any one of claim 1 to claim 3, wherein said first field magnet is fixed to a shaft, said second field magnet is provided movably and freely with respect to said shaft, said shaft and said second field magnet have screw functions to be connected to each other by forming a bolt screw portion in said shaft and a nut portion inside said second field magnet, a displacement in an axial direction of said second field magnet is detected, and a lead angle of current supply by a controller for controlling said inverter is

Sub A2> corrected corresponding to a positional shift angle of a composite magnetic pole of said first field magnet and said second field magnet.

7. An electric motor according to claim 1 or claim 2, wherein said first field magnet is fixed to a shaft, said second field magnet is provided movably and freely with respect to said shaft, and a plurality of supporting mechanisms capable of guiding rotational motion and reciprocal motion and the composite motion of said second field magnet is arranged between said second field magnet and said shaft.

8. A rotary electric machine according to claim 1 or claim 2, wherein said first field magnet is fixed to a shaft, said second field magnet is provided movably and freely with respect to said shaft, and a sleeve is inserted between the inside of said second filed magnet and said shaft to fix said second field magnet to said sleeve.

9. A rotary electric machine according to claim 8, wherein said sleeve is made of a non-magnetic material having an electric resistivity higher than that of iron.

10. An electric motor according to claim 1 or claim 2, wherein said first field magnet is fixed to a shaft, said second field magnet is provided movably and

freely with respect to said shaft, a plurality of springs is arranged before and after said second field magnet to guide the rotational motion and the reciprocal motion and the composite motion of said second field magnet.

11. An electric motor according to claim 1 or claim 2, wherein said first field magnet is fixed to a shaft, said second field magnet is provided movably and freely with respect to said shaft, a depressing portion is formed on a side surface of said first field magnet where said first field magnet and said second field magnet are in contact with each other, a projecting portion also serving as a function of said sleeve is formed in said second field magnet.

12. An electric motor according to claim 1 or claim 2, wherein said first field magnet is fixed to a shaft, said second field magnet is provided movably and freely with respect to said shaft, and a stopper is arranged at a position apart from a side surface of said second field magnet, said stopper having a supporting mechanism for guiding rotational motion and reciprocal motion and the composite motion to said second field magnet and said shaft.

13. An electric motor according to claim 1 or claim 2, wherein said first field magnet is fixed to a shaft, said second field magnet is provided movably and freely with respect to said shaft, an air gap between said rotor having said

second field magnet and said stator is larger than an air gap between the rotor having said first field magnet and said stator.

14. An electric motor according to claim 1 or claim 2, wherein said first field magnet is fixed to a shaft, said second field magnet is provided movably and freely with respect to said shaft, said stopper and said servo mechanism are provided inside of said second field magnet.

15. A machine tool according to claim 1 or claim 2, wherein said electric motor is operated by making positions of the magnetic pole centers of said first field magnet and said second field magnet in phase during low speed operation, and by making the positions of the magnetic pole centers of said first field magnet and said second field magnet out of phase during high speed and low load operation.

16. A machine tool according to claim 1 or claim 2, wherein said electric motor is operated by making positions of the magnetic pole centers of said first field magnet and said second field magnet in phase during the operation at one revolution speed, and by making the positions of the magnetic pole centers of said first field magnet and said second field magnet out of phase during the operation at the other revolution speed.